Virginia Libraries Broadband Assessment

2016

Assessing the broadband speeds, costs and utilizations across Virginia libraries.

Broadband Access and Utilization Assessment

C I T
CENTER FOR INNOVATIVE TECHNOLOGY

CGIT
Center for Geospatial Information Technology

LIBRARY OF VIRGINIA

2015 Virginia Libraries Broadband Assessment

Contents

EXECUTIVE SUMMARY

Background

Internet access has quickly progressed from being a 'novelty' to be a necessity for education, healthcare, economic development, public safety and citizen engagement.   Internet access has developed based on private business economics and not regulated to ensure that every American has adequate and affordable access. Our country adopted a National Broadband Plan in March 2010. That plan includes several national broadband goals with one being having 100 million homes with 100 Megabits per second (Mbps) connections by 2020.   In 2010 the federal definition of broadband was 4Mbps download and 1Mbps upload and was upgraded in January 2015 to the current definition which is 25 Mbps download speed with a minimum upload speed of 3 Mbps. Many citizens often look to public libraries to access the connectivity they need, and may not have available at home, it is important that our libraries have quality, broadband connections.   For the purposes of this assessment, we will use the current definition of broadband.

Broadband access is a priority in today's world and most view broadband as an essential utility. As we continue to resolve Internet access deficiencies in our un-/underserved areas, we must also assess the ways we are leveraging broadband to improve our communities and our lives. Libraries across our nation have evolved in response to the importance of technology and the Internet providing broadband access and technology services to their patrons. That evolution has led our libraries to take on many additional roles including supporting education, providing digital literacy training, workforce development services and in many communities they have become the public computer access center. In many cases, public libraries offer the fastest Internet connections available in a community.   In our rural areas, the libraries are often the only place families can access the Internet and unfortunately too many parents find themselves spending evenings in the library parking lot so their children can access the Internet to complete their homework assignments.

As we consider the increasingly important role that our libraries play in our communities' future, CIT Broadband conducted the first annual assessment of how libraries are connecting to the Internet, the associated costs, the quality of their connections and how we could improve both access and utilization in late 2014.

We worked with the Library of Virginia to conduct Internet speed test campaigns and have mapped and analyzed those results for the past few years. Starting the fall of 2014, we worked with the Library of Virginia to incorporate broadband related questions into their annual survey of all libraries and merged these survey responses with other important data sources.   In this latest assessment we leveraged an updated speed test campaign, Universal Service Administrative Company (USAC) E-rate data filed by libraries and the 2015 Library of Virginia survey to provide us with a more comprehensive look at our libraries from a broadband perspective.

2015 Virginia Libraries Broadband Assessment

Key Findings

- Annually, Virginia libraries purchase over two million dollars of Internet related services.

- Annually Virginia libraries spend in excess of $160,000 on very old, slow and expensive T-1 services.

- The Library of Virginia provides full E-Rate services to libraries for a small percentage of a libraries E-Rate discount.

- 74% of responding libraries provide workforce development assistance to patrons.

- Most library systems purchase 'true broadband' capacity. Those that do not, are mostly rural library systems.

- 13 libraries experienced excessively high latency while running the library speed test. Of those, 12 were rural.

- The lack of digital literacy is known to be a primary barrier to broadband adoption.

- Almost half (also 47%) of the libraries reported they have more demand for computer related assistance than there are resources to provide that assistance.

- There are 8 Virginia library systems that do not purchase download connections that meet the FCC recommended service levels to spur digital literacy and promote adoption.

- Twenty-five (25) library systems do not purchase the equivalent of true broadband. Of those that do not purchase 'true broadband', most (80%) are rural systems.

The following section summarizes the areas of focus of this assessment, provides detailed findings and includes our recommendations presented in bold font.

FOCUS AREAS AND RECOMMENDATIONS

Cost of Internet Access

We learned from our first assessment of Virginia's public libraries that we needed to gather more information about what libraries pay for their connectivity to be able to perform a comprehensive cost analysis. In 2015 the Library of Virginia included additional survey questions about the cost of Internet services to libraries and connection characteristics. The information provided by survey questions helped us evaluate whether libraries across the state are receiving the connectivity characteristics they should for the amount they pay.

Using additional data gathered from the Universal Service Administrative Company (USAC,) an independent authority, recognized and designated by the FCC as the administrator of universal service, enabled us to access Virginia's libraries Internet related costs.

For one library system the T-1 service purchased for just one branch is more expensive than the fiber and cable connections purchased for all the other branches in the system.

We looked closely at how much Virginia library systems pay for their Internet services, and what kinds of services are being purchased. Internet related costs for Virginia's public libraries vary significantly depending on the technology purchased and whether a library is urban or rural. For this reason, we will be using median values in cost related discussions unless otherwise specified.

Annually, Virginia libraries purchase over two million dollars of Internet related services. There are approximately twice as many rural library systems as there are urban. Annual costs for rural libraries are approximately 87% of annual urban costs; $972,084.72 versus $1,155,218.76 respectively.

Monthly broadband related costs vary widely, ranging from $55 to over $17K. The lowest monthly cost was reported was for a 25 Mbps cable connection to a rural library. The highest monthly cost reported was for fiber access services totaling 800 Mbps to an urban library.

The highest cost per Mb was for a rural library, paying more than 20 times the median. The highest urban cost per Mb was about 10 times more than the median.

In Craig Settles's highly regarded publication, "Libraries: Broadband Leaders of the 21st Century [1]" he notes the unfortunately reality that some libraries are still stuck with very old services and reminds us that T-1 services are at least 50 years old, and very expensive.   Annual expenditure for T-1 service to libraries in Virginia exceeds $160,000. We found that six of Virginia's library systems, four rural, two urban purchase 1.5 Mb T-1 services, ranging in cost from $109 – over $10,000 per month. For one library system the T-1 service purchased for just one branch is more expensive than the fiber and cable connections purchased for all the other branches in

---

[1] Available at: : http://cjspeaks.com/wp/wp-content/uploads/2016/04/snapshot-03-16.pdf
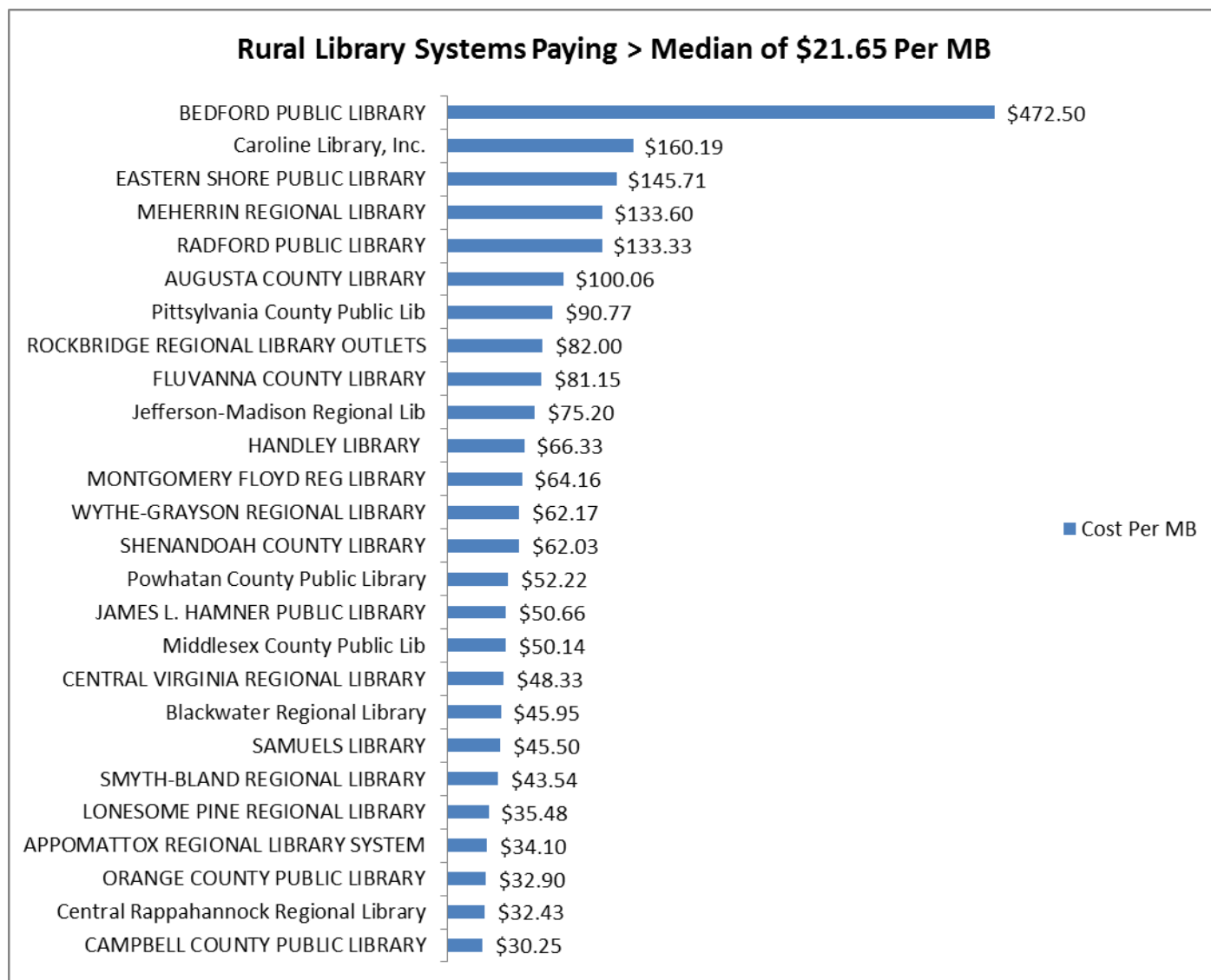
the system. **Virginia should work with these library systems to find other, more cost effective broadband solutions. One solution may be to leverage e-Rate funding to deploy fiber to the branch leveraging the money currently allocated to fund the T-1 and possibly have the community benefit in additional ways from that fiber build.**

Where possible, we calculated cost per megabit download per month. We noted only a minor difference in the median cost between urban verses rural libraries; $26.13 per Mb versus $21.65 per Mb respectively.
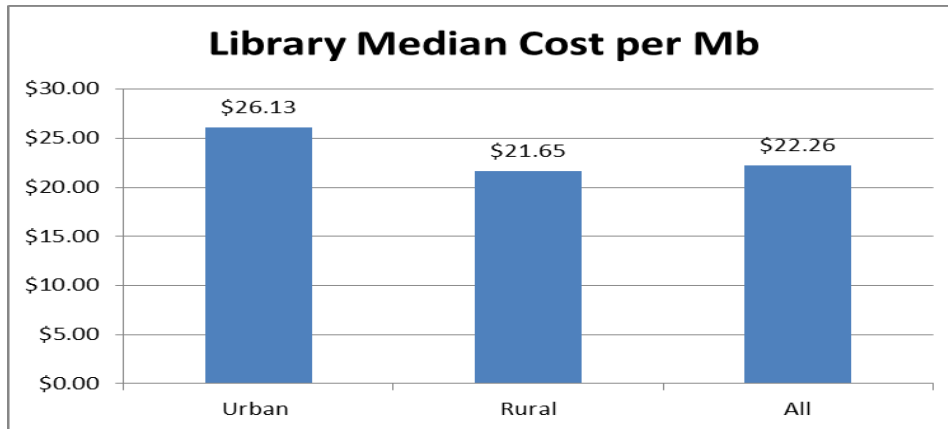
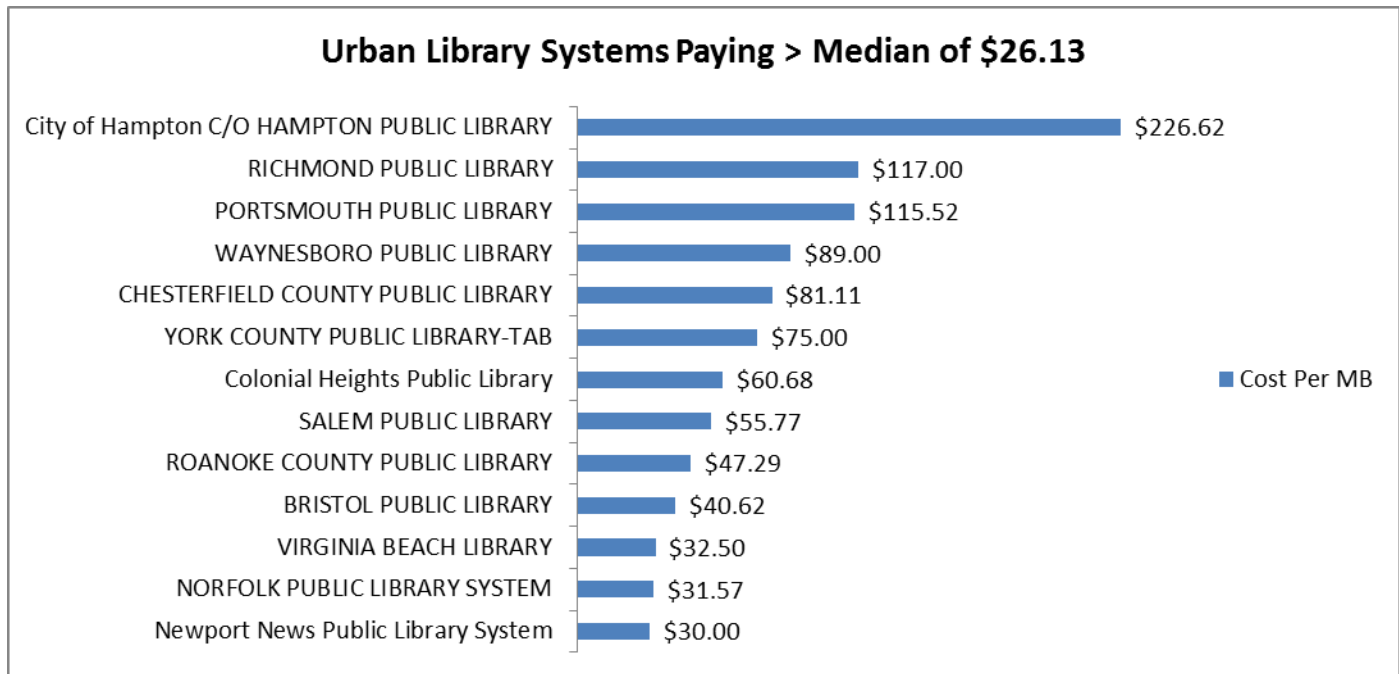There were twice as many rural library systems (26) than urban (13) that pay more per Mb than the overall median cost of $22.26. The highest cost per Mb was for a rural library, paying more than 20 times the median. The highest urban cost per Mb was about 10 times more than the median. **Virginia should work with these libraries to assess why they pay significantly more per Mb than other library systems.**

2015 Virginia Libraries Broadband Assessment

Rural Library Systems Paying > Median of $21.65 Per MB

Library	Cost Per MB
BEDFORD PUBLIC LIBRARY	$472.50
Caroline Library, Inc.	$160.19
EASTERN SHORE PUBLIC LIBRARY	$145.71
MEHERRIN REGIONAL LIBRARY	$133.60
RADFORD PUBLIC LIBRARY	$133.33
AUGUSTA COUNTY LIBRARY	$100.06
Pittsylvania County Public Lib	$90.77
ROCKBRIDGE REGIONAL LIBRARY OUTLETS	$82.00
FLUVANNA COUNTY LIBRARY	$81.15
Jefferson-Madison Regional Lib	$75.20
HANDLEY LIBRARY	$66.33
MONTGOMERY FLOYD REG LIBRARY	$64.16
WYTHE-GRAYSON REGIONAL LIBRARY	$62.17
SHENANDOAH COUNTY LIBRARY	$62.03
Powhatan County Public Library	$52.22
JAMES L. HAMNER PUBLIC LIBRARY	$50.66
Middlesex County Public Lib	$50.14
CENTRAL VIRGINIA REGIONAL LIBRARY	$48.33
Blackwater Regional Library	$45.95
SAMUELS LIBRARY	$45.50
SMYTH-BLAND REGIONAL LIBRARY	$43.54
LONESOME PINE REGIONAL LIBRARY	$35.48
APPOMATTOX REGIONAL LIBRARY SYSTEM	$34.10
ORANGE COUNTY PUBLIC LIBRARY	$32.90
Central Rappahannock Regional Library	$32.43
CAMPBELL COUNTY PUBLIC LIBRARY	$30.25

Urban Library Systems Paying > Median of $26.13

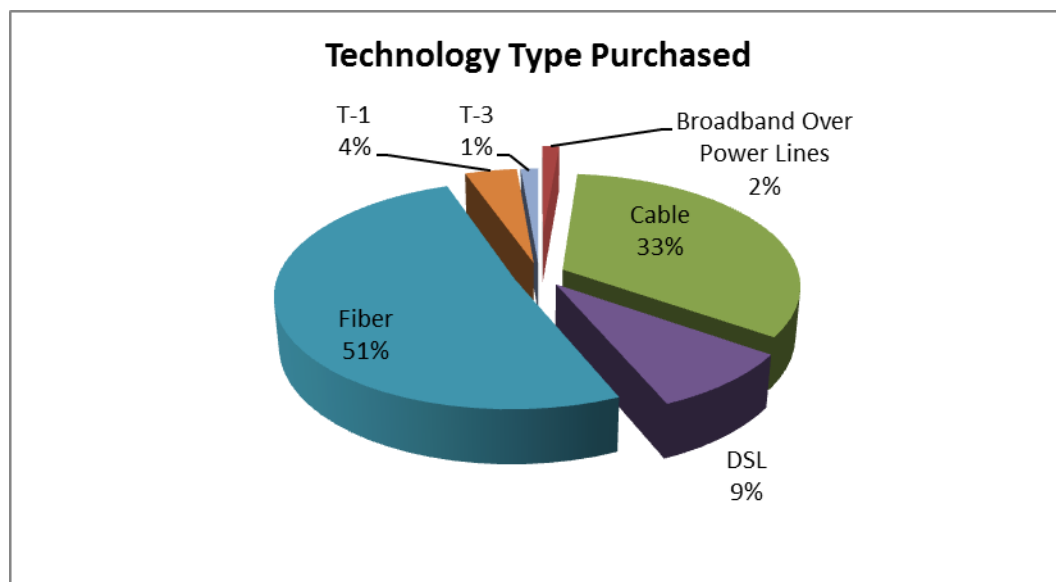| Library System	Cost Per MB
City of Hampton C/O HAMPTON PUBLIC LIBRARY	$226.62
RICHMOND PUBLIC LIBRARY	$117.00
PORTSMOUTH PUBLIC LIBRARY	$115.52
WAYNESBORO PUBLIC LIBRARY	$89.00
CHESTERFIELD COUNTY PUBLIC LIBRARY	$81.11
YORK COUNTY PUBLIC LIBRARY-TAB	$75.00
Colonial Heights Public Library	$60.68
SALEM PUBLIC LIBRARY	$55.77
ROANOKE COUNTY PUBLIC LIBRARY	$47.29
BRISTOL PUBLIC LIBRARY	$40.62
VIRGINIA BEACH LIBRARY	$32.50
NORFOLK PUBLIC LIBRARY SYSTEM	$31.57
Newport News Public Library System	$30.00

When cost per Mb is considered with respect to the particular Internet related services purchased we noted significant variance. For instance, the lowest cost per download Mb per month was for an urban library system that purchases fiber services from their municipality at $.63 for a 1,154 Mb connection. The highest cost per download Mb per month was for a rural library system at $473.00 for a 10 Mb fiber connection. These two examples highlight the cost differential associated with connecting to a municipally owned network versus commercially purchased services. The municipality in this example is also cited in the work by Craig Settles for their creativity in extending the impact of E-Rate programs.

Almost all library systems purchase typical access technologies – the same we see residential customers in Virginia using; fiber, cable, DSL. However, it should be noted that one rural library system purchases a connection type not generally offered in Virginia; Broadband Over Power Lines (BOP), costing ($34.10) 57% more than the rural median cost per MB.   Our data does not indicate why this connection type is purchased. This is a controversial technology because of its documented interference with Ham Radio frequencies.

Most library systems (51%) purchase fiber connections. Fiber is the primary connection type purchased by urban library systems. Cable connections are more prevalent in rural library systems.

Except for BOP, overall cable represented least expensive technology per Mb and T-1 services by far the most expensive.
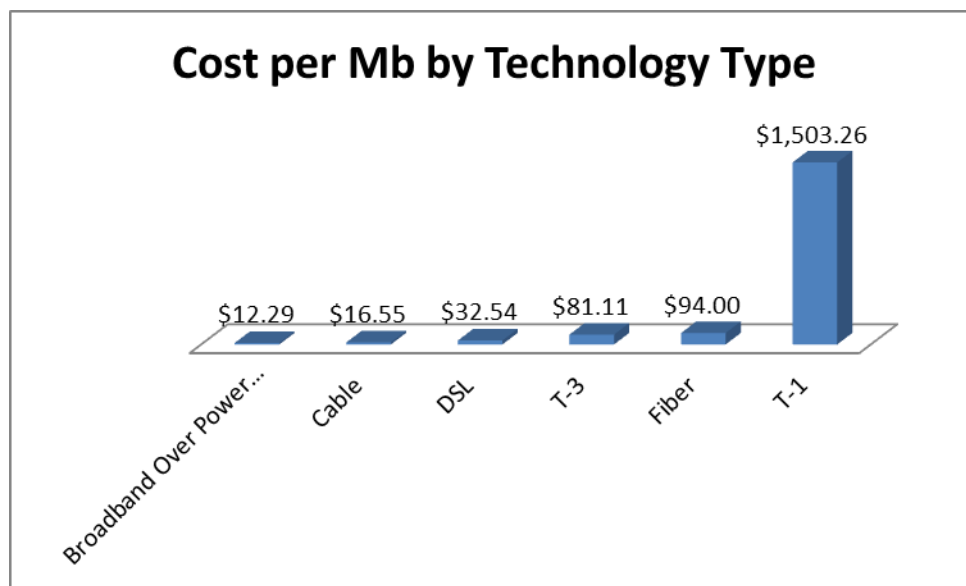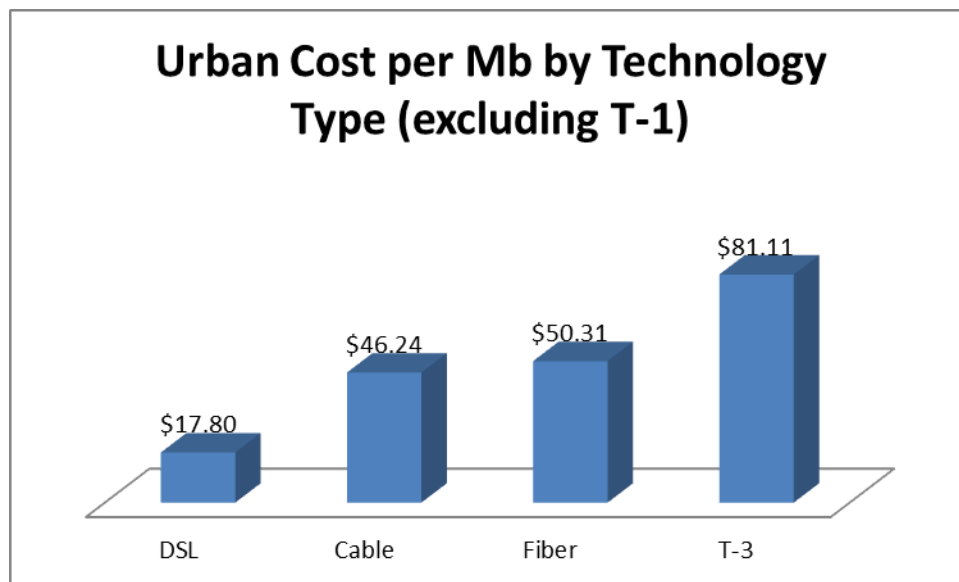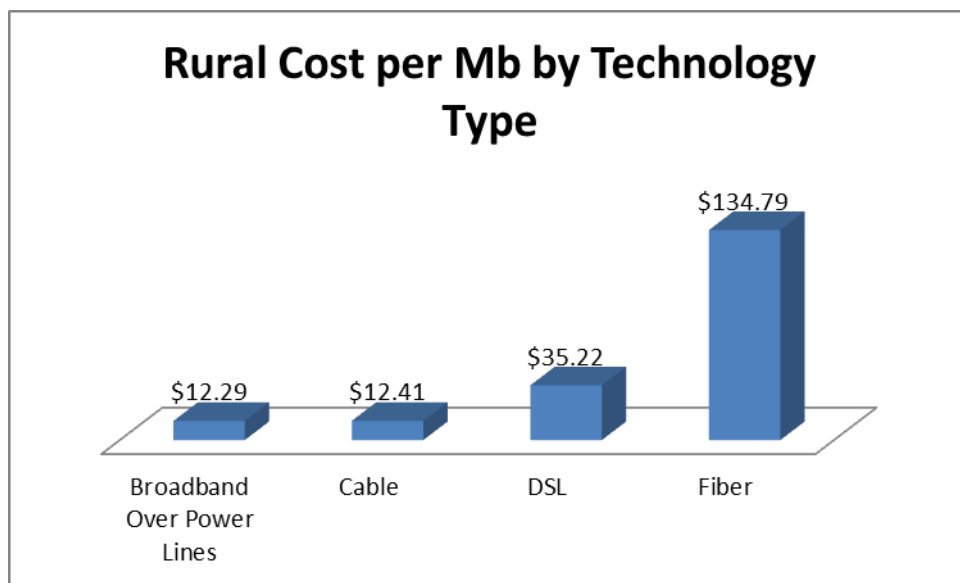

The six library systems that reported purchasing T-1 services are:

- AUGUSTA COUNTY LIBRARY,
- BLACKWATER REGIONAL LIBRARY,
- CENTRAL RAPPAHANNOCK REGIONAL LIBRARY,
- HAMPTON PUBLIC LIBRARY,
- NOTTOWAY LIBRARY SYSTEM,
- SHENANDOAH COUNTY LIBRARY.

Upon closer examination of the USAC data with regard to T-1 services we noted the cost reported for one urban system was excessive. We could not with confidence report cost per Mb for T-1 services, therefore we chose not to include that technology in our reporting of urban and rural costs per Mb by technology.

Urban libraries pay more per Mb for cable services than rural systems. DSL and Fiber technologies cost about twice as much per Mb- in rural localities than in urban.

Rural Cost per Mb by Technology Type

- Broadband Over Power Lines: $12.29
- Cable: $12.41
- DSL: $35.22
- Fiber: $134.79

Urban Cost per Mb by Technology Type (excluding T-1)

- DSL: $17.80
- Cable: $46.24
- Fiber: $50.31
- T-3: $81.11

When every dollar counts and every patron is counting on their libraries to deliver the best Internet performance in a locality, the need to secure the best possible service is obligatory.   Fortunately, the Library of Virginia runs a program they call the E-Rate sustainability program in which they offer full E-Rate support (in return of about 8% if e-rate discounts) to help libraries secure the best Internet options possible. However, this program is only offered to libraries that participate in the E-Rate program.

Virginia library systems that are not currently participating in the Library of Virginia Sustainability program should consider taking advantage of their services.

We identified 13 library systems that currently do not participate in the E-Rate program: Arlington Department of Libraries, Clifton Forge Public Library, Colonial Heights Public Library, Cumberland County Public Library, Fauquier County Public Library, Franklin County Public Library, Iris Brammer Library, Mary Riley Styles Public Library, Newport News Public Library System, Pearisburg Public Library, Prince William Public Library System, Richmond County Public Library, Staunton Public Library,
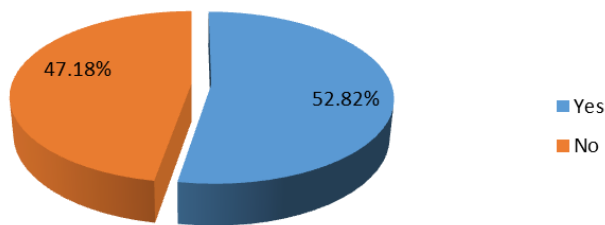
Digital Literacy Training

The goal of digital literacy training is to help patrons understand the basics of computer uses; how to use a computer, how to access the Internet, how to perform basic Internet searches, how to protect themselves and their identity online and more. Libraries play an important role in that they provide a friendly, informal, comfortable community setting in which to learn what can be intimidating for many.   By learning computer basics, patrons can begin to utilize broadband services for educational, occupational, health, entertainment and many other purposes. These online activities build localized broadband adoption which in turn is important for making a business case for broadband access expansion into unserved areas. The lack of digital literacy is known to be a primary barrier to broadband adoption.

The lack of digital literacy is known to be a primary barrier to broadband adoption.

Every community needs to ensure free digital literacy training is available for their citizens. Virginia libraries did not make progress in the past year of increasing digital literacy training computer classes. Nearly half of Virginia libraries (47%) report they **do not** provide digital literacy training. More urban libraries responded that they do provide digital literacy classes than did rural libraries. This may be because broadband is typically more available to urban populations thus more demand for classes. Rural libraries often lack resources which may account for the lack of providing digital literacy training.

According to Craig Settles - "expect the libraries' role to become even greater as the FCC retools its Lifeline program, which has a billion or two to contribute to the effort."

% of Libraries Offering Digital Literacy Computer Classes

47.18%
52.82%

- Yes
- No

Urban - Rural % of Libraries Offering Digital Literacy Computer Classes

23.16%

29.66%
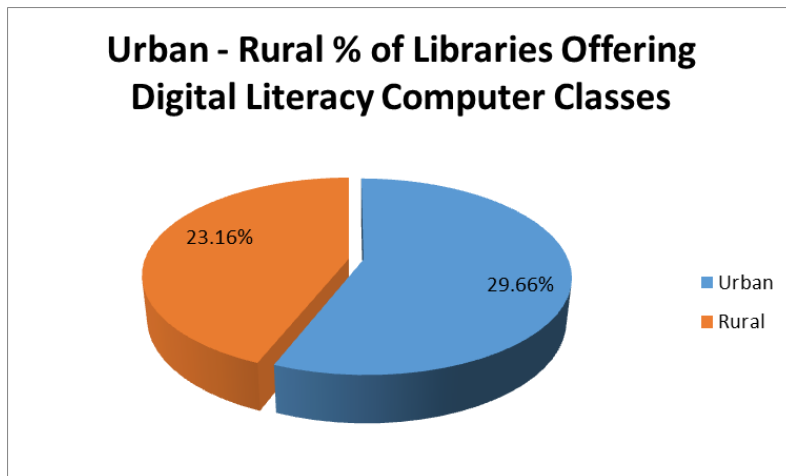
- Urban
- Rural

Similarly almost half (also 47%) of the libraries reported they have more demand for computer related assistance than there are resources to support. Demand and lack of resources at rural libraries was only slightly greater than at urban libraries. Lack of the ability to assist patrons with computer related activities may also account for the lack of progress in increasing digital literacy classes.

More Demand for Computer Related Assistance than Resources

24.29%

22.29%

- Urban
- Rural

Because digital literacy leads to broadband adoption, it is vitally important that libraries be able to provide computer related assistance and digital literacy classes to ensure all Virginia's have the ability to leverage broadband to improve their lives and ultimately improve our communities. Craig Settles also points out that "libraries are being designated the main outpost for digital literacy programs." He says that we should "expect the libraries' role to become even greater as the FCC retools its Lifeline program, which has a billion or two to contribute to the effort."
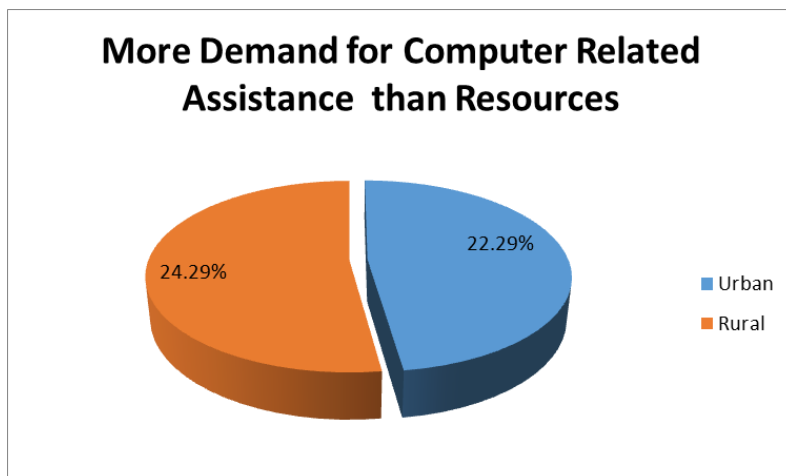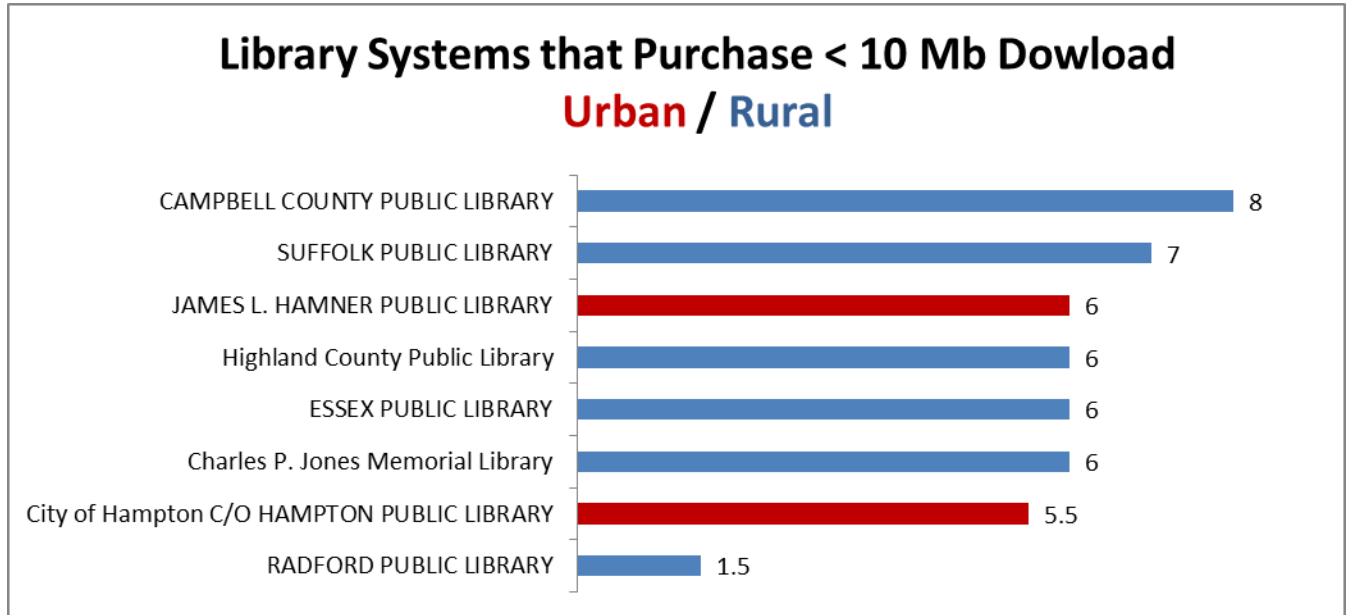
A final comment on the importance of digital literacy; the lack of digital literacy is a known barrier to broadband adoption. The FCC has noted the steady increase in broadband adoption rates associated broadband performance of least a minimum speed of 10 Mbps download 1 Mbps upload and latency of

less than 100 milliseconds round trip – more on latency later. The FCC has set this level of broadband service as a requisite for providers accepting Community Connect broadband expansion grants.

There are 8 Virginia library systems that do not purchase download connections that meet the FCC recommended service levels to spur digital literacy and promote adoption.

Library Systems that Purchase < 10 Mb Dowload
Urban / Rural

Library	Value
CAMPBELL COUNTY PUBLIC LIBRARY	8
SUFFOLK PUBLIC LIBRARY	7
JAMES L. HAMNER PUBLIC LIBRARY	6
Highland County Public Library	6
ESSEX PUBLIC LIBRARY	6
Charles P. Jones Memorial Library	6
City of Hampton C/O HAMPTON PUBLIC LIBRARY	5.5
RADFORD PUBLIC LIBRARY	1.5

Workforce Training

On the other hand, a majority of Virginia libraries (74%) report that they offer workforce training classes. Workforce training in this context is professional, educational training delivered to patrons via a library Internet connection. Workforce training can provide a cost effective way to receive training to advance job-related skills. Slightly more rural libraries (40%) than urban libraries (37%) offer workforce training. This may be due to the greater need of rural populations for professional development opportunities as traditional industry continues to evolve to take advantage of the digital age and telework opportunities expand.

% Libraries Offering Workforce Development Classes

26% No
74% Yes

Internet Speed and other important characteristics

While speed is an important characteristic of an Internet connection, other factors, such as latency and capacity add value by allowing libraries to serve more patrons with better throughput. Speed is how fast a connection is and capacity is how many can utilize that connection and realize sufficient speed to run the applications and services they require. Generally the more patrons using a libraries connection, the slower and more congested the connection is. The importance of capacity as noted by Settles "continues to increase as patrons bring their own networked devices with them and expect to connect each of them to the library's network." Capacity and speed all depend upon the technology type used, and speed tier purchased.

Latency

Another important connection characteristic is latency. Latency is the time it takes for data to travel back and forth over a broadband network. As noted earlier, the FCC has designated 100 milliseconds a maximum threshold sufficient for motivating demand for digital literacy training, and broadband adoption.

There are 13 libraries systems (12 rural, 1 urban) that recorded median latency measures greater than 100 milliseconds. Of those libraries that recorded high latency, 70% (9) also recorded median download speeds of less than 10 Mbps.

When slow connections are coupled with high latency measures, the overall experience is very unsatisfactory, frustrating and all online activities suffer. Because median values were used those connections with greater than 100 ms may be seriously constrained. High latency can be caused by many factors outside a library or service provider's control; internal networking, age of computers, computer, router and mis-configurations, the path data travels to and from a computer are just a few. **Libraries that continually struggle with slow connection speeds coupled with high latency measures should work with their system and service provider to identify potential causes for these conditions and find potential solutions.**
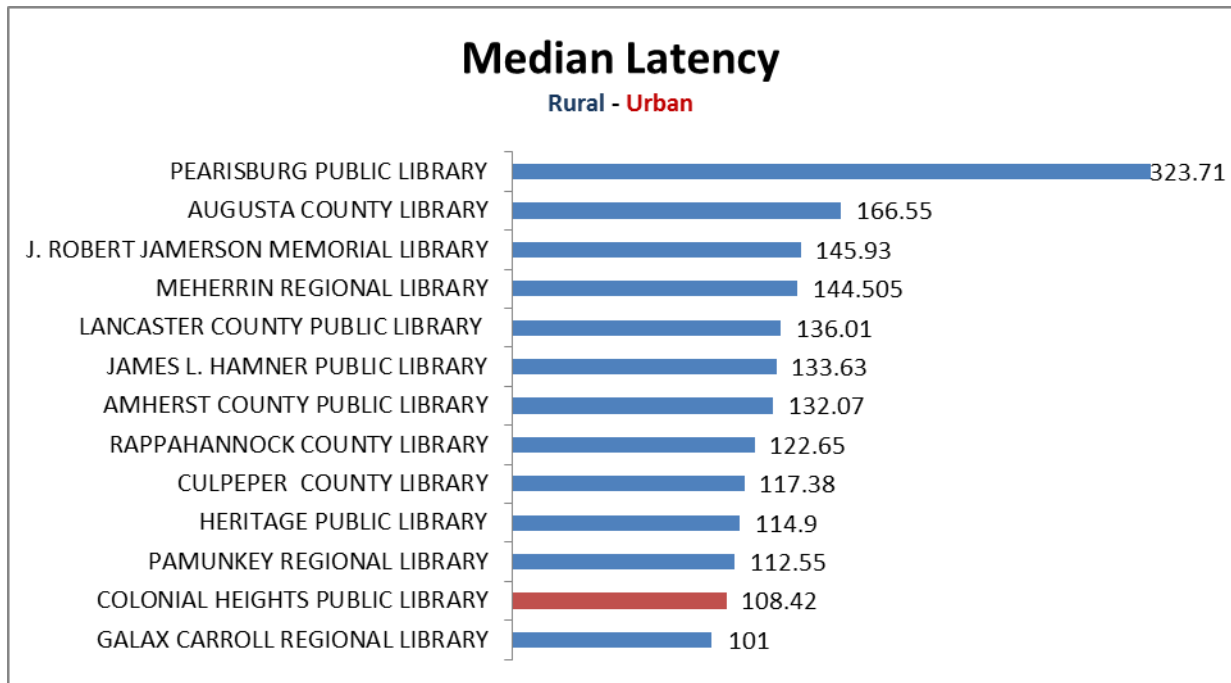
> *There are 13 libraries systems (12 rural, 1 urban) that recorded median latency measures greater than 100 milliseconds. Of those libraries that recorded high latency, 70% (9) also recorded median download speeds of less than 10 Mbps.*
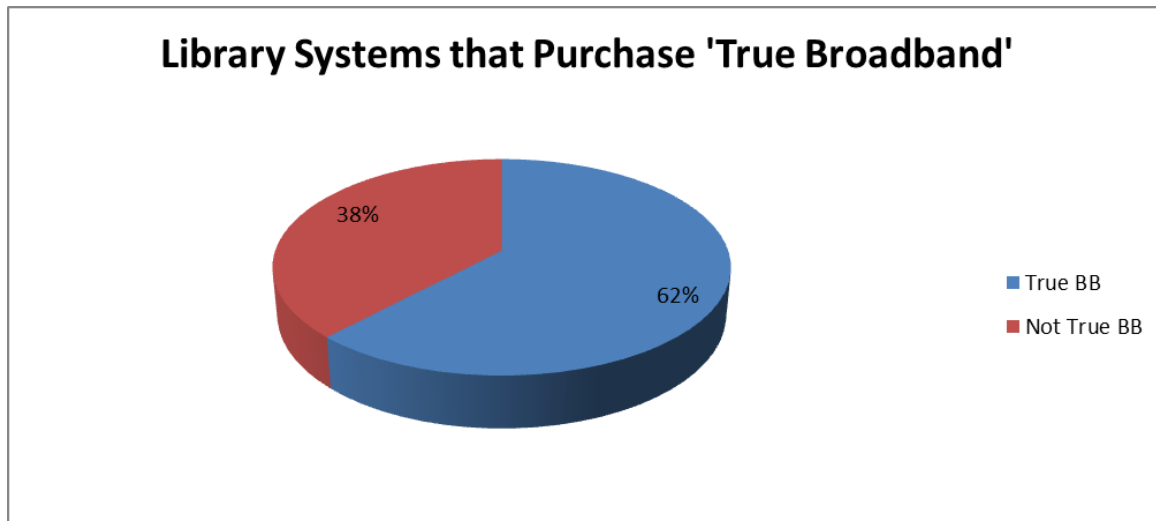
Median Latency
Rural - Urban

Library	Median Latency
PEARISBURG PUBLIC LIBRARY	323.71
AUGUSTA COUNTY LIBRARY	166.55
J. ROBERT JAMERSON MEMORIAL LIBRARY	145.93
MEHERRIN REGIONAL LIBRARY	144.505
LANCASTER COUNTY PUBLIC LIBRARY	136.01
JAMES L. HAMNER PUBLIC LIBRARY	133.63
AMHERST COUNTY PUBLIC LIBRARY	132.07
RAPPAHANNOCK COUNTY LIBRARY	122.65
CULPEPER COUNTY LIBRARY	117.38
HERITAGE PUBLIC LIBRARY	114.9
PAMUNKEY REGIONAL LIBRARY	112.55
COLONIAL HEIGHTS PUBLIC LIBRARY	108.42
GALAX CARROLL REGIONAL LIBRARY	101

True Broadband

Most library systems (62%) purchase connections that equate to true broadband according to the FCC's latest designation of 25 Mbps download.

Library Systems that Purchase 'True Broadband'

Category	Percentage
True BB	62%
Not True BB	38%

Twenty-five (25) library systems do not purchase the equivalent of true broadband. Of those that do not purchase 'true broadband', most (80%) are rural systems.

14

Library Systems that do not Purchase True Broadband

Urban / Rural

Library	Value
Caroline Library, Inc.	22.5
Middlesex County Public Lib	20
MECKLENBURG COUNTY PUBLIC LIBRARY (FKA Southside Regional)	20
FLUVANNA COUNTY LIBRARY	20
MEHERRIN REGIONAL LIBRARY	16
GLOUCESTER LIBRARY	16
CULPEPER COUNTY LIBRARY	16
ROCKBRIDGE REGIONAL LIBRARY OUTLETS	15
HERITAGE PUBLIC LIBRARY	15
AUGUSTA COUNTY LIBRARY	13.5
WAYNESBORO PUBLIC LIBRARY	12
YORK COUNTY PUBLIC LIBRARY-TAB	10
SAMUELS LIBRARY	10
NORTHUMBERLAND PUBLIC LIBRARY	10
J. Robert Jamerson Memorial Library	10
BEDFORD PUBLIC LIBRARY	10
CAMPBELL COUNTY PUBLIC LIBRARY	8
SUFFOLK PUBLIC LIBRARY	7
JAMES L. HAMNER PUBLIC LIBRARY	6
Highland County Public Library	6
ESSEX PUBLIC LIBRARY	6
Charles P. Jones Memorial Library	6
City of Hampton C/O HAMPTON PUBLIC LIBRARY	5.5
CHARLOTTE COUNTY LIBRARY	5
RADFORD PUBLIC LIBRARY	1.5

Libraries (along with schools) often have the best network connections available within localities. **Because demand for Internet related services and applications are expected to continue to evolve and increase into the foreseeable future, all libraries should strive to purchase 'true broadband' connections.**

Download Speed

While the majority of library systems purchase connections that equate to true broadband, individual branches may not experience those speeds. Looking at speed tests across branches gives us insight into how purchased speed tiers are distributed among branches. 30% of the branch libraries that conducted speed tests logged true broadband speeds, and 70% of libraries that experience speeds that no longer qualify as broadband. 36% of those experience speeds that are insufficient for promoting broadband adoption.
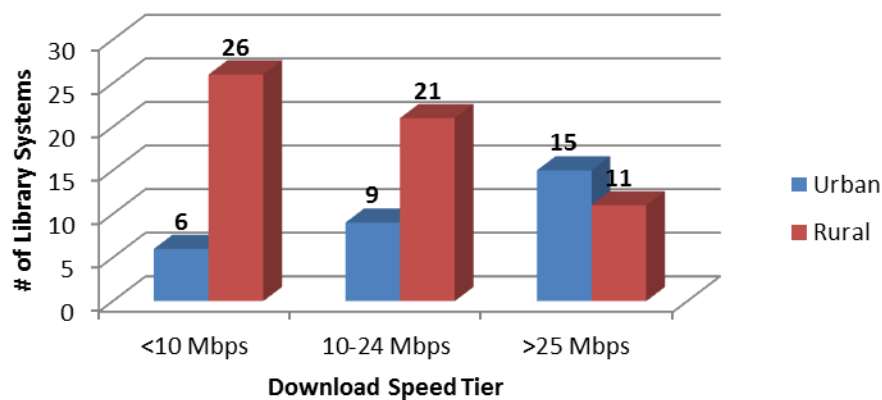
Median Download Speeds Across Library System Branches

(Pie chart)

- <10 Mbps: 36%
- 10-24 Mbps: 34%
- >25 Mbps: 30%
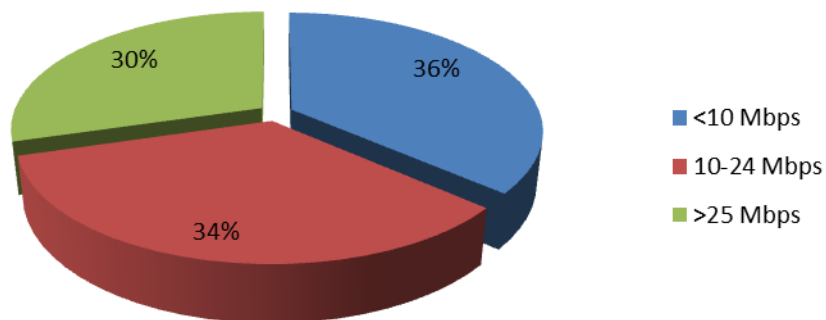
Libraries reporting slow download speeds should to examine their broadband access quality, total demand, internal networking and work with their system to discover the root causes and identify opportunities to improve the access.

Urban v. Rural Library Systems Median Download Speeds

(Bar chart — # of Library Systems vs. Download Speed Tier)

Download Speed Tier	Urban	Rural
<10 Mbps	6	26
10-24 Mbps	9	21
>25 Mbps	15	11

CONCLUSION

Libraries' roles in our communities continue to evolve as they increasingly fill the gap in broadband access in our rural areas, supplement other resources to facilitate workforce development and take on the incredibly important role of digital literacy training to not only prepare our citizens for the future but to also affect the economics that impact anyone's ability to expand Internet access in our rural areas. We all must acknowledge these critical roles in our communities and continue to provide our libraries with the support they need to continue to assist our communities' moves into the future. We do not want citizens left behind in education, employment, healthcare or any other aspects of life because they do not have access to or the skills to leverage Internet applications. CIT Broadband sincerely hopes this information is valuable and can be leveraged to provide the support our libraries need to ensure the benefits of broadband are realized by every community.